The Ineliminable Distortion of Reality: On Causality, Representation, Abstraction and Idealization in Batterman's Philosophy of Science

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On Causality, Representation, Abstraction and Idealization in Batterman's Philosophy of Science

Abstract

Robert Batterman claims that asymptotic explanations in physics are acausal, involve un-de-idealizable idealizations and are counter-examples to the mapping account of the role of mathematics in physics. In this paper, I analyze and criticize aspects of this claim, especially its implications for metaphysics and to a lesser extent methodology in physics. Regarding causality, Batterman has advocated that explaining emergent physical phenomena such as the universality of critical exponents in phase transitions involve throwing away causal details, and that we should replace Kim's requirement of emergents having novel causal powers with emergents figuring in novel explanatory stories, see (Batterman, 2002). I argue that Batterman's view of causality is ontologically too restrictive. I also argue that it is methodologically too restrictive, in that abstractions in science, including some involved in examples given by Batterman, e.g. (Batterman, 2002) (Batterman, 2009) almost always involve throwing away details (causal or otherwise), but that this does not imply throwing away the category itself (e.g. causality), see also (Batterman & Rice, 2014), (Lange, 2015). I further argue that even if physical explanations do not directly appeal to causal factors at the macro level, they presuppose them. For instance, the modeler's choice of which parameters (or dimensions) are essential to the explanation of a certain phenomenon and which are consequently taken as a starting point for a dimensional analysis, see (Batterman, 2002), (Barenblatt, 1979), presupposes a causal structure of the universe in terms of dependent and independent variables. Sometimes such presuppositions can be explicated as ontological assumptions built into systems of units of measurement. If no causality is presupposed, the account

will be subject to the same type of criticism as the deductive-nomological model, e.g. why not explain the length of strings of pendulums via an analysis of parameters connected to their periods and gravitational acceleration? I conclude that although asymptotic explanations do not directly appeal to causality, they do not exclude causality at the macro-level and there are many prima facie reasons to keep causality at this level. I defend this against claims made about the existence of non-causal explanations in physics, e.g. by claiming that physical explanations require a global theory, see (Wayne, 2015) or that they proceed by appealing to fictional highly idealized models in physics, see (Bokulich, 2011), (Pexton, 2014), (Wayne, 2015). I claim that these arguments do not preclude that causality is presupposed at the macro-level, except perhaps in quantum theoretical explanations in which case an appeal to Bohr's correspondence principle may be required, a mystery which will not be solved here.

Going into more details with asymptotic explanations, I argue that Batterman's argument that these are mathematical operations and not mathematical structures, see (Batterman, 2010), is not convincing, as the distinction between a mathematical operation and a structure is very hard to uphold. I also argue that his argument that they are counterexamples to the mapping account of mathematical explanations in physics is imprecise in one aspect, as an idealized misrepresentation of a phenomenon is still a representation of that phenomenon. I find at the core of Batterman's view on asymptotic explanations an ineliminable distortion of reality, the appeal to the singularity. One central problem in that discussion is whether we should consider reality itself as distorted in the singularity, and our representation of it to be correct in some sense, or we should say that our representation of reality is distorted and important aspects of reality are unknown to us? I comment on this question.

I conclude that the existence of asymptotic explanations should not influence our views of causality at the macro-level and that they are not convincing counter-examples to the mapping account of

mathematical explanation in physics. They do, however, point to a very central problem in the interpretation of physical terms, i.e. what actually happens in the singular limit?

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